

afforded by a few judiciously selected illustrations, but these the author considers undesirable.

The large number of drugs dealt with renders the book extremely valuable for reference, but the defects alluded to militate against its efficiency as an educational work for students. HENRY G. GREENISH.

MAGNETO- AND ELECTRIC-OPTICS.

(1) *Magneto- und Elektro-optik*. By Dr. Woldemar Voigt. Pp. xiv+396. (Leipzig: B. G. Teubner, 1908.) Price 14 marks.

(2) *Cours de Physique*. Cinquième Partie. Électroptique. Ondes Hertiennes. By Prof. H. Bouasse. Pp. 426. (Paris: Delagrave, n.d.) Price 14 francs.

(1) THIS is a work on one of the most fascinating branches of modern science by one of those who have done most towards its development. To all students of physics the volume is to be specially recommended as giving an admirable account of a subject which has the most intimate bearing on present theories of the constitution of matter; to those who are themselves working in the same field the name of the author will be sufficient to indicate that the book is indispensable.

The subject dealt with is not the electromagnetic theory of light in general, but, in Prof. Voigt's own words, "that special branch of optics which deals with the action of a magnetic or an electric field on the optical properties of bodies." The study of this special branch of optics may be said to have begun in 1845 with Faraday's experimental demonstration that the plane of polarisation of a beam of polarised light is rotated by the action of a magnetic field having its lines of force parallel to the direction in which the light is travelling. Since that date an enormous amount of attention has been given to the phenomena due to the action on light of a magnetic or an electric field. In 1876 Kerr succeeded in detecting the rotation of the plane of polarisation when light is reflected normally from the surface of a ferromagnetic metal in a strong magnetic field. In 1896 Zeemann showed that the periods of free vibration of the light emitted by a flowing gas are changed by the direct action of a magnetic field, and that there is a corresponding action on an absorbing medium. In 1898 Voigt himself showed that a body in a magnetic field becomes doubly refractive in the direction perpendicular to the lines of force, in the same manner as a uniaxial crystal perpendicular to its axis. In the section of electro-optics, the advances made are less marked. Kerr's demonstration that an isotropic insulating substance becomes doubly refractive in the direction perpendicular to the lines of electric force may be taken as fundamental. An army of workers has followed along the main lines thus indicated, and to-day the mere marshalling of the known facts of observation is a task of no small difficulty, while there are many points of which theory yet fails to give any convincing explanation.

Prof. Voigt's book is founded on lectures given by him at Göttingen University. The material thus NO. 2076, VOL. 81]

available, however, has clearly been greatly extended and amplified, with results which may be regarded as exceptionally satisfactory. Thus the elementary and fundamental facts of observation, as well as all the more important experimental appliances and apparatus, are very fully and clearly described, while, on the other hand, a large amount of detail as to the latest developments, both in experiment and theory, is included. In a branch of knowledge so necessarily subject to modification under the influence of new ideas, it is usually to be expected that a volume will be already almost antiquated by the date of its publication, but one of the chief claims of the present work to attention is the extent of the information given as to the most recent work.

The first two chapters are devoted to setting forth the fundamental observations and the principal experimental methods and developments in connection with the Faraday effect and the Zeeman effect. The two chapters following, covering some 120 pages, are concerned with the explanation of these observations on the electron theory. The chief feature of Voigt's own work is the establishment of a simple connection between the emission and absorption phenomena and the rotatory effect of the magnetic field, and the development of the theory here given is founded on the series of papers published by the author between 1898 and 1902 in the *Annalen der Physik*. The theory is, however, here further extended, and includes, in chapter v., a discussion of Becquerel's more recent experiments on crystals of compounds of the rare earths.

The remaining chapters are devoted to the discussion of the "magnetic" Kerr effect, and the consideration of the fundamental phenomena of electro-optics. In the field of electro-optics the experimental difficulties have rendered progress slow. Insulation breaks down under very high voltages, and conduction is never entirely absent, and more refined methods of observation are necessary before the indications of theory can be verified. The subject is, however, of great theoretical interest and importance, and the publication of the present work will no doubt do much in stimulating further research.

(2) The general plan of the "Cours de Physique," of which the present volume is the fifth part, is somewhat unusual. The volumes previously issued bear the titles:—(1) "Mécanique Physique"; (2) "Thermodynamique—Théorie des Ions"; (3) "Électricité et Magnétisme"; (4) "Optique. Étude des Instruments," the part here considered being devoted to the general discussion of electromagnetic radiations, including Hertzian waves. Part vi. is to be entitled "Étude des Symétries"; from the references in the present volume we gather that this might best be translated "Crystallography." We are by no means clear that the arrangement thus outlined is satisfactory. In the volume before us especially, the inclusion of the discussion of Hertzian waves, though entirely logical and perfectly defensible on theoretical grounds, seems to us unfortunate. The questions involved are essentially practical and of special interest to the electrician, and the early chapters devoted to

their treatment form a section quite distinct from the remainder of the volume.

At the same time, it must be remembered that the whole work is one written for the student, and from this point of view it may be maintained that the logical arrangement is to be preferred. The usefulness of such an extended general treatise on physics is, however, far from being limited to the purposes of a university course, and the convenience of the older student who needs his theory for its application to practice might well have received more consideration.

It is to be remarked also that Prof. Bouasse's "Cours de Physique" is essentially a treatise on mathematical physics. The author takes a keen interest in the most recent developments in physical science from the theoretical point of view, but it is not to him that we should turn for information as to experimental work.

This premised, it may be said that the work is one which should command attention. Prof. Bouasse has the faculty of presenting his mathematics in a clear and attractive form, and his theoretical discussion of practical points often presents novelties of value to the practical experimenter.

The first chapter is devoted to the discussion of Maxwell's equations of the electromagnetic field. It is unfortunate that so much reference to vol. iii. of the work should be necessary, but, nevertheless, the matter is presented with admirable clearness, and the student has no cause to complain of the author's dictum:—

"The reader cannot spend too much time on this first chapter; if he understands it well, all the rest of the volume will appear clear to him. If he fails to understand it—*nous ne saurions trop lui conseiller d'abandonner la théorie électromagnétique de la lumière.*"

Then follows the section of some seventy pages on Hertzian waves and their application in wireless telegraphy. The treatment is of interest; it includes an account of the general theory and a mathematical discussion of various practical questions, especially the propagation of a disturbance along a wire; but it is necessarily incomplete, and would be of more value in a volume not so specially devoted to optical theory.

The main part of the work is that devoted to the discussion of double refraction and of polarised light. The theory is directly based on that of the propagation of electromagnetic waves in an anisotropic medium; from this is deduced the equation of the wave surface and the construction of Fresnel. This leads up to a sufficiently full treatment of the phenomena connected with double refraction as dealt with in any modern treatise on physical optics; as elsewhere, the mathematical presentment has many original and attractive features.

In the succeeding chapters reflection and refraction, dispersion and absorption are fully discussed from the standpoint of the electromagnetic theory. A somewhat brief treatment of the electron theory leads to the consideration of the Zeemann effect, and the phenomena of emission, phosphorescence and fluorescence, &c., while the concluding chapter deals with the

thermodynamics of space, including such topics as Poynting's experiments on radiation pressure and the discussion of Stefan's law.

As has been sufficiently indicated, the whole of the section of physical optics here dealt with is treated as a deduction from the equations of the electromagnetic field. This may be a simplification from the point of view of theory, but we are inclined to think that to the student it may give an air of unreality to a subject which, above all others, is based on the most complete and exact experimental data.

OUR BOOK SHELF.

On the Poison of Venomous Snakes and the Methods of preventing Death from their Bite. Reprinted papers by the late Sir Joseph Fayrer, Sir Lauder Brunton, and Major Leonard Rogers. Pp. iii+174. (London: Macmillan and Co., Ltd., 1909.) Price 2s. 6d. net.

THIS publication consists of a re-issue in book form of six papers reprinted from the Proceedings of the Royal Society. The first four papers deal with the physiological action of snake venoms. They were first published more than thirty years ago, and then represented important advances in knowledge. They cannot, however, be expected to reflect the present-day knowledge of the action of snake venoms. The fifth paper, belonging to the same period, deals with chemical methods of destroying the activity of cobra poison, such as by chloride of gold or of mercury. The last paper, which was published in 1904, and is the only one of the series in which the last-named author cooperated, deals with the experimental results of the treatment of snake-bite by free exposure of the wound and local application of potassium permanganate.

To be of practical service in the treatment of snake-bite, any remedial measure must be rapidly available and easily applicable. To meet these conditions, one of the authors devised a special instrument consisting of a small lancet-shaped blade to expose the wound made by the serpent's bite, this blade being set in a short wooden handle, which is hollowed so as to form a receptacle for sufficient permanganate of potash. Experiments were made on rabbits and cats to test the value of the method and instrument. The results, especially in the latter animals, were encouraging, in so much as it was found that death could be prevented from a dose of venom considerably larger than that which was sufficient to kill a control animal. At the same time, it may be pointed out that the conditions of these experiments do not represent adequately the conditions obtaining in an ordinary case of snake-bite. The efficacy of the antidotal action of potassium permanganate depends solely upon how far the venom can before absorption be destroyed by intimate contact with the permanganate. In the authors' experiments the venom was injected into the subcutaneous tissues, in which case it was relatively easy to ensure contact of the venom with the antidote, whereas in a case of snake-bite the venom is injected usually into deeper tissues, when it is much more difficult to bring the permanganate into contact with the venom. It is thus probable that these experimental results ascribe to this method of treatment a value higher than would be found to attend it in practice.

While from its simplicity and cheapness this method of treating snake-bite ought not to be lost sight of, it probably does not represent the ideal attainment, which is by local application and general administration of an antivenomous serum, and further efforts ought to be made in the direction of obtaining such serums of